

Abstract ID: 91

Title: Spatiotemporal activity based and route sensitive air pollution indicators for epidemiologists

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Text:

Background and aims: For traffic related air pollution, huge variability of meteorology, traffic, traffic dynamics and route choice hampers accurate exposure and health assessments. One of the main issues in exposure science and epidemiology is applying the complex exposure and dose functions to the personal time activity pattern of the individuals in custom populations, for example in epidemiological cohorts.

Methods: Noise measurements are used to quantify the instantaneous traffic and traffic dynamics in parallel with air pollution measurements. Instantaneous spatiotemporal LUR models with a high resolution (10 seconds while in-traffic) can assess and disentangle the PM exposure variability into a local traffic component and a slow varying background component. Instantaneous μ LUR models are built for bicyclists using noise measurements under various conditions. μ LUR models sensitive to instantaneous meteorological conditions are built for in-vehicle and indoor exposure using noise maps as an alternative proxy to traffic data. A personal exposure data workflow can apply the μ LUR models to any custom population. The exposure assessments can be extended to dose and indicator assessments with the temporal resolution of the μ LURs.

Results: Disentangling the air pollution variability into a meteorological component and a local traffic component improves the prediction of the personal exposure significantly. Noise maps capture the effects of traffic in a spatial resolution matching the spatial variability of the traffic related particulate matter (BC and UFP). Personal attributes of the subjects in a cohort enable the simulation of time-activity patterns. External validation of the personal exposure model for Black Carbon is successful.

Conclusions: Activity and micro-environment specific μ LURs can calculate complex exposure and dose including non-linear effects of the individual behavior including route choice. A personal indicator dataflow framework can extrapolate the μ LURs to any custom population and has the potential to improve the policy support and health effect research.